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Auditing Municipal Energy Use

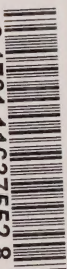


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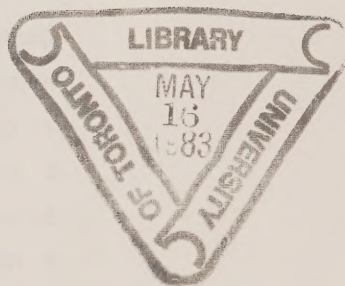
Auditing Municipal Energy Use

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For further information, contact your provincial department of energy or the Department of Energy, Mines and Resources, Ottawa.



Auditing Municipal Energy Use

Introduction

A systematic audit of municipal energy consumption can be decisive for the success of conservation efforts. The data base produced by the audit can specify what kinds of energy are used, how much is consumed and at what cost for each municipal function. This is essential background for effective energy planning and program monitoring.

By providing a baseline measure of the level of energy use, the audit information allows municipal officials to compare energy consumption levels over time. Thus the effectiveness of conservation measures can be measured in real fuel - and dollar - savings.

With energy use accountable in this way, there is additional motivation for departmental managers to keep a rein on energy consumption within their jurisdictions. And an accurate measure of savings is vital proof, both to staff and to decision-makers, that conservation measures are worthwhile.

Other benefits are more immediate. The audit identifies areas where energy consumption is highest, and this in turn suggests where conservation measures might be most productive. Additionally, it provides a basis for establishing priorities among conservation measures by comparing potential savings from capital investments.

Audit information also makes long-range energy planning possible by presenting fuel consumption as energy units as well as dollars. Once levels and concentrations of energy use have been identified by energy type, municipal officials can assess possibilities for fuel substitution, potentially an important tool of municipal energy management. Municipal vulnerability to supply disruption also becomes more evident when reliance on various fuel types is highlighted. And the data base provides the background the municipality will need for contingency planning.

Finally, in carrying out an energy audit the municipality sets a process in motion. Because it involves every department, the

audit reinforces staff awareness that energy consumption has become an issue and engages municipal employees directly in the conservation program itself. In this way it can complement other efforts to publicize the program and encourage changes in the energy use patterns of individual staff members.

1- The Audit Procedure

Step-by-step audit instructions are available in "Municipal Energy Audit: A Practical Guide to the Identification of Energy Expenditures"*, Department of Energy, Mines and Resources.

The audit procedure set out in this book was developed on the basis of an energy survey of municipal functions in the City of Ottawa. Later this same method was tested in six Canadian cities ranging in size from 1,800 to 560,000 population. The study itself was intended to show Canadian municipalities how to document their internal energy use patterns, and to help them determine the potential for conservation in various municipal operations.

Generally speaking, the approach resembles standard financial audit procedures already familiar to many municipal officials: energy consumption data and/or fuel cost data are collected for each energy-consuming activity over a 12 month period. Included are 65 ready-to-use forms and detailed instructions on their use. These forms set out the energy-consuming elements in each municipal function and provide a detailed breakdown of energy use and costs. In addition, because buildings offer such significant energy savings, that data is separated out in summary sheets.

* Available from Buildings Division, Conservation and Renewable Energy Branch, Department of Energy, Mines and Resources, 580 Booth Street, Ottawa K1A 0E4.

Municipal functions are broken down as follows:

- administration, office services and general services
- parks
- street lighting
- water supply
- sewerage and sewage disposal
- public transit
- police service
- fire service
- sanitation - garbage collection and disposal
- road maintenance - ice and snow control
- road maintenance

For each specific function the text describes survey findings in the seven municipalities. Thus the publication offers interesting insights into municipal energy use in Canada, as well as a tested audit procedure.

Rather than reproduce existing material, this section highlights the principal information blocks compiled in the audit. Thus it illustrates the extent and detail of the data base which can be developed using this audit procedure. The text concludes by discussing some critical considerations in carrying out this data collection, based on experience gained in the test communities.

2- How the Audit is Structured

How much energy is consumed by the various services the municipality provides? Based on information drawn from departmental records and from energy suppliers, the audit sets out the pattern of total municipal energy use, broken out by specific functions. By using the summary charts for energy use in municipal buildings, conservation officials can quickly identify the municipality's top energy consumers. Buildings can account for more than half the total municipal energy consumption, and here it becomes evident just where conservation efforts will be most fruitful.

This information, however, must be analyzed in the context of local services and municipal facilities. Consequently it is essential to prepare an inventory and description of municipal infrastructure and

holdings first - roadways, sewers and watermain, sewage pumping stations, treatment installations, garbage collection and disposal facilities, public transit, police, fire and mobile fleet equipment, yard depots and workshops, and finally municipal administration buildings and buildings for general use.

Two other factors must also be taken into consideration: town characteristics and the climate. Data from Statistics Canada and from municipal files will set out a precise description of the town. This portion of the audit draws in information on population, employment patterns and economic characteristics, financial statistics, and various physical characteristics affecting energy use in municipal operations.

Finally, the Atmospheric Environment Service of Environment Canada will provide all the material necessary to develop a meteorological description of the community - temperature ranges, degree days, snowfall and rainfall, and hours of daylight.

3- Organizing the Audit Process

What is involved for the municipality? Experience in the test communities has provided some insight into the process of actually carrying out an audit.

Normally an audit team will work with all municipal departments, whether filling in forms themselves or assisting with data collection. This team, which should be made up of two or three people, will need three to four months to complete its task. Depending on its circumstances, the municipality can appoint its own employees or it can hire temporary staff specifically for the project.

Either choice has advantages. If municipal employees conduct the audit, they develop detailed knowledge of how energy is consumed in the municipality, and can be valuable contributors to the energy management program. There is also a good chance that working on the audit will heighten their interest and enthusiasm as they become aware of the potential for reducing energy use in municipal operations. Finally, and not least, conducting the audit in-house avoids extra costs.

The energy audit can be time consuming, however, and hiring temporary staff may be the best solution if employee workloads are already heavy and no one can be spared from normal responsibilities.

The audit team may also encounter serious obstacles in retrieving and presenting energy cost data. Municipalities generally receive bills specifying dollar figures and not fuel amounts, and few have a breakdown of energy bills by department or end use.

As a result of their experience, several municipalities who have compiled data bases are now modifying budgeting and accounting procedures to permit on-going monitoring and analyses of municipal energy costs. In some cases this has involved extended negotiations with suppliers to change billing formats. Most towns will be breaking new ground in their attempt to gather information for the audit. However, the importance of consistent data and improved energy accounting are becoming increasingly evident.

Finally, the problems that arise in comparing data must also be recognized. Different forms of energy are measured in different units. These can be converted to a common energy unit (G.J.)* by using a conversion factor. Even reduced to the same unit, however, energy units bear different costs. Therefore the common energy units are useful only in comparisons, and have no real value on their own.

4- Characteristics of a Successful Audit

Experience has also highlighted characteristics of a successful audit. First, the project must have the support of the highest authority in the municipality and the ready cooperation of everyone involved. It must be realized that the people consulted will already have a heavy workload, and may not appreciate additional responsibilities. Some departments may also be reluctant to open their records. The audit team must therefore make a particular effort to allay suspicion and to explain carefully how important it is that the audit be done and done well.

Careful attention to detail is also essential. Paperwork can become voluminous, and record keeping must be organized and methodical. In view of the extensive amount of arithmetic to be done, frequent checks and cross-checks are necessary to avoid possible error. And because billing and accounting procedures change, flexibility is necessary so that information can be interpreted within the framework of the base audit. It is therefore important to assign the right people to each task, people who are familiar with municipal operations, and capable of working methodically.

5- Sample Forms

Two samples from the set of audit forms have been included here to illustrate the audit process more clearly, the first analyzing energy consumption in relation to a municipal function (Parks and Recreation) and the second a separate breakdown summarizing energy use in buildings.

Designed to document energy consumption in municipal operations, the audit focuses on 12 municipal functions. Consequently the audit procedure uses 12 sets of forms similar to the sample (Parks and Recreation), one for each major area of municipal responsibility. The sample set is included to indicate the level of detail provided for. It identifies each energy consumer by energy type for all recreation-related municipal activities, and provides a summary of recreation-related energy use.

The second set of sample forms, Part U (Buildings), are summary sheets which bring together information assembled specifically on buildings during the audit of all municipal functions. Since buildings are the highest energy consumer in the municipality, these summary charts are particularly useful and provide an excellent basis for early program planning. Buildings are also the easiest energy conservation targets: because of the complexity of their energy control systems, they offer many opportunities for improvements. Using this overview, the energy management committee can quickly identify the major energy consumers and then carry out individual building audits to pin-point the most effective energy-conserving measures to introduce.

* See page 6

MUNICIPAL ENERGY AUDIT — YEAR
PART E — PARKS & RECREATION

FOR FURTHER DETAILS, CONSULT:

NAME _____

TITLE:

TELEPHONE NO. _____

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SECTION E1 — BUILDINGS

[illegible]

Source: Municipal Energy Audit: A Practical Guide to the Identification of Energy Expenditures, Energy, Mines and Resources, Buildings Series No. 3.

MUNICIPAL ENERGY AUDIT — YEAR
PART E — PARKS & RECREATION (contd.)

PAGE NO. 19

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SECTION E2 — VEHICLES

OWNERSHIP	NO. OF VEHICLES	NO. OF AUTO. MOBILES	GASOLINE		DIESEL	
			/ CONSUMED	Km DRIVEN	/ CONSUMED	Km DRIVEN
MUNICIPAL HIRED						
TOTAL						

SECTION E3 — OTHER MISCELLANEOUS ENERGY CONSUMPTION: SPECIFY

MUNICIPAL ENERGY AUDIT — YEAR
SUMMARY SHEET PART E — PARKS AND RECREATION

PAGE NO.

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SECTION E4 — FUEL SUMMARY

FUEL TYPE	NATURAL UNIT	BUILDINGS	VEHICLES	OTHER	TOTAL IN NATURAL UNITS	CONVERSION (MULTIPLY BY)	BUILDINGS	VEHICLES	OTHER	TOTAL BY FUEL TYPE GJ
ELECTRICITY	kWh					0.0036				
GASOLINE	litre					0.0346				
DIESEL OIL	litre					0.0386				
FUEL OIL No. 2	litre					0.0386				
FUEL OIL No. 6	litre					0.0416				
KEROSENE	litre					0.0376				
PROPANE	litre					0.0271				
NATURAL GAS	m ³					0.0373				
SEWER GAS	m ³					0.0199				
STEAM	kg					.00225				
OTHER										
TOTAL BY FUNCTION (GJ)										

SECTION E5 — VEHICLE EFFICIENCY

	VEHICLE ENERGY GJ (E4)	km DRIVEN (E2)	km/ GJ EQUIV.
GASOLINE			
DIESEL			
TOTAL			COMBINED GASOLINE AND DIESEL km/ GJ EQUIV.

ENTER APPROPRIATE VALUES ON
PAGES 56, 57, 58

SECTION U2 — BUILDINGS OPERATED BY OTHERS FOR MUNICIPAL PURPOSES

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MUNICIPAL ENERGY AUDIT — YEAR
SUMMARY SHEET PART U — MUNICIPAL BUILDINGS (contd.)

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SECTION U3 — FUEL SUMMARY — BUILDINGS

FUEL TYPE	NATURAL UNIT	OPERATED BY MUNICIPALITY	OPERATED BY OTHERS	OTHER	TOTAL IN NATURAL UNITS	CONVERSION (MULTIPLY BY)	OPERATED BY MUNICIPALITY	OPERATED BY OTHERS	OTHER	TOTAL BY FUEL TYPE GJ
ELECTRICITY	kWh					0.0036				
GASOLINE	litre					0.0346				
DIESEL OIL	litre					0.0386				
FUEL OIL No. 2	litre					0.0386				
FUEL OIL No. 6	litre					0.0416				
KEROSENE	litre					0.0376				
PROPANE	litre					0.0271				
NATURAL GAS	m ³					0.0373				
SEWER GAS	m ³					0.0199				
STEAM	kg					.00225				
OTHER										
TOTAL BY FUNCTION (GJ)										

GRAND TOTAL "BUILDING ENERGY" GJ

MUNICIPAL ENERGY AUDIT — YEAR
PART U — MUNICIPAL BUILDINGS (contd.)

PAGE NO.

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SECTION U4 — SURVEY MUNICIPALITY BUILDINGS — DETAILS OF 'TOP TWELVE' ENERGY CONSUMERS

BUILDING	FLOOR AREA m ²	BLDG. VOLUME m ³	AGE	RM. TEMP. °C	HEATING SOURCE	EXTENT OF AIR CONDITIONING	KITCHEN FAC. YES/ NO	ELEVATORS (YES/ NO)	NO. OF OCCUPANTS & PERIOD OF OCCUP.	TYPE OF CONSTRUCTION & STATE OF REPAIR
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
TOTALS										

REMARKS:

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MUNICIPAL ENERGY AUDIT — YEAR
PART U — MUNICIPAL BUILDINGS (contd.)

SECTION U5 — TOP TWELVE ENERGY CONSUMERS — FUEL

BUILDING NAME	AREA m ²	FUEL CONSUMPTION					
		ELECTRICITY kWh	FUEL OIL No. 6 / l	FUEL OIL No. 2 / l	NATURAL GAS m ³	STEAM kg	OTHER
TOTAL							
% NATURAL UNIT TOTAL P 61							

